Lesson 4. Division of Gymnosperm

Purpose: To get acquainted with the cycle of development of Gymnosperms on the example of Scots pine. To learn how to make a morphological description of representatives of the Division of Gymnosperm**.**

Initial level questions

1. General characteristics of the Division of Gymnosperm. Progressive features of the division that appeared in the process of evolution.
2. Peculiarities of the cycle of development of the Gymnosperms division by the example of the Pinus sylvestris.
3. Structure of vegetative organs of Gymnosperms.
4. Structure of generative organs of Gymnosperms.
5. Brief characteristic of the class Conifers.
6. National-economic and medical importance of representatives of Gymnosperms.

Instructions for the work

Equipment: microscope, magnifying glasses, dissecting needles, slides and coverslips, blades, filter paper strips, eosin**.**

Materials: female and male pine cones fixed in alcohol; herbarium of representatives of the Gymnosperms division; fresh branches of representatives of the class conifers.

Permanent micro preparations: longitudinal section through a male pine cone, pine pollen.

Methodology for the work

Task 1. The structure of the male cone of the Scots pine.

Consider the male cones of Scots pine fixed in alcohol, paying attention to their location on the shoot. Find microstrobilus axis, microsporophylls and sporangia.

Consider under low magnification of the microscope a permanent micropreparation "Longitudinal section through the male cone of pine". Find the axis of the cone, the scales spirally attached to it - microsporophylls and microsporangia. Determine the degree of maturity of microsporangia (mature ones contain mature pollen, immature ones contain microsporocytes). Do all sporangia mature at the same

time?

Draw a male pine cone and mark in the picture: cone axis, microsporophylls, microsporangia, pollen (Fig. 1).

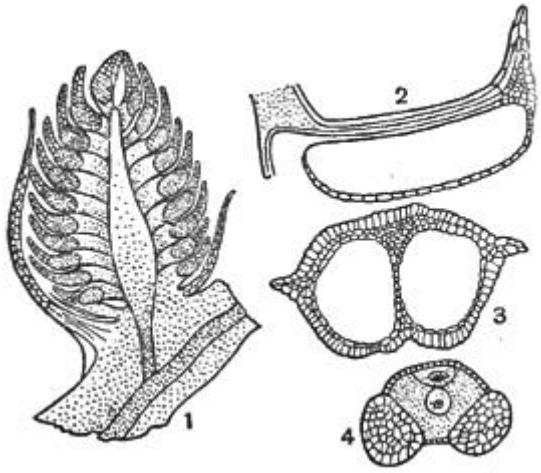

Fig. 1. Structure of the male pine cone (Adapted from: http://worldofschool.ru/biologiya/stati/botanika): 1 - longitudinal section of the male pine cone, 2 - longitudinal section of microsporophyll with sporangia, 3 - transverse section of sporophyll with sporangia, 4 - pollen grain.

Task 2. The structure of the female cone of the Scots pine.

Consider an unfertilized female pine cone under a binocular microscope. Find the seed and covering scales. Note that the female cone is a collection of megastrobils. Split the cone on the dissecting table of the binocular microscope with two needles and isolate one megastrobillus. Each strobilus consists of three megasporophylls: two fertile - fused into seed scales and one sterile - covering scales. Find the megasporophylls. Consider on the inner surface of the seminal scale at its base two small whitish tubercles, facing the apex to the axis of the female cone. These are the ovules, from which seeds will form the next year.

Consider a female cone of the second year of life. Make its longitudinal incision and examine it under a binocular microscope. Look at the fusion of the seed and covering scales.

Draw a general view of a pine shoot with female cones and mark the axis of the cone, megastrobilus, seed scales with seed buds and covering scales.

Task 3. The structure of the pollen of the common pine tree.

Prepare a temporary preparation of common pine pollen. To do this, take the pollen with the tip of a dissecting needle, place it in a drop of water on a slide and cover it with a coverslip. Consider the micropreparation under low magnification of the microscope. Change the microscope to high magnification and choose a dust pollen

lying sideways. In this position, the pollen appears to consist of three parts. The middle part is the gametophyte, the other two are air sacs formed by the outer shell of the exine. The surface of the exine has a reticulate pattern. In order to better examine the internal structure of pollen, some eosin is injected under the coverslip to reveal the borders between the antheridial and vegetative cells of the gametophyte (the borders are only visible when the pollen is in the lateral position). The anteridial cell is on the protruding, air sac-free part, is lenticular in shape, and slightly extends into the vegetative cell. The vegetative cell occupies the rest of the pollen. Examine the permanent micropreparation and compare it with the temporary one. Sketch the pollen grain from the micropreparation and mark the intina, exina, air sacs, antheridial cell, and vegetative cell.

Task 4: Study the development cycle of Gymnosperms using the example of Scots pine.

Sketch the developmental cycle of the Scots pine. Note the duration of cone development. Note that at the time of pollination, the male cone has already formed microgametophytes, while the female cone has not even formed a megaspore yet. In the figure, mark all the phases of the cycle and the time of their formation relative to each other (Fig. 2).

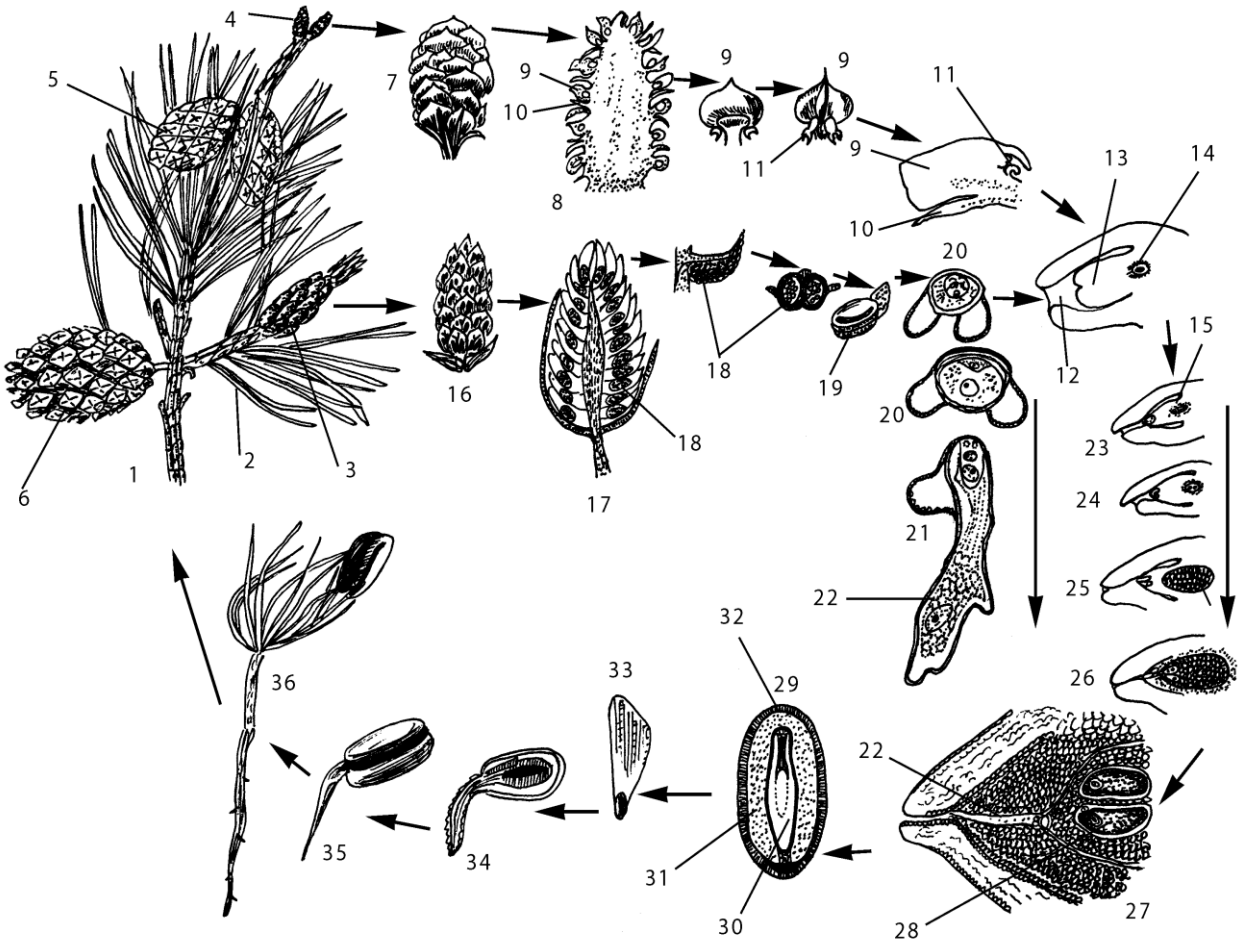

Fig. 2. Life cycle of Pinus sylvestris (Orig.)

1 - pine sporophyte branch with male and female cones, 2 - needle leaves, 3 - male cones, 4 - female cones of the first year, 5 - female cones of the second year, 6 - female cones of the third year, 7 - appearance of a female cone of the first year, 8 - longitudinal section of first-year female cone, 9 - seed scales, 10 - covering scales, 11 - ovule, 12 - micropyle, 13 - nucellus, 14 - archesporial cell, 15 - megaspora, 16 - appearance of male pine cone, 17 - longitudinal section of male pine cone, 18 - longitudinal and transverse section through microsporophyll, 19 - microsporangium, 20 - pollen grain, 21 - germination of pollen grain into pollen tube after pollination, 22 - pollen tube with forming sperms, 23- 26- formation of megametophyte and archegonium with ovules, 27- fertilization, 28- archegonium with ovule, 29- longitudinal section through seed, 30- embryo, 31- endosperm, 32- seed coat, 33- seed with wing for wind spread, 34-36- germination of seed

Questions for self-control

1. State the features of the anatomical structure of the stems of Gymnosperms plants.

2. What is the male cone of a pine tree?
3. How is the female pine cone arranged?
4. What is a pollen grain? Where is it formed?
5. What is pollination? How does it occur in Gymnosperms?
6. Define the terms: nucellus, integument, ovule, seed.
7. Why do megaspores and megametophyte in Gymnosperms develop after pollination?
8. What adaptations do representatives of gymnosperms have to spread seeds?